Electronic Supplement to

Impulse Response of Civil Structures from Ambient Noise Analysis

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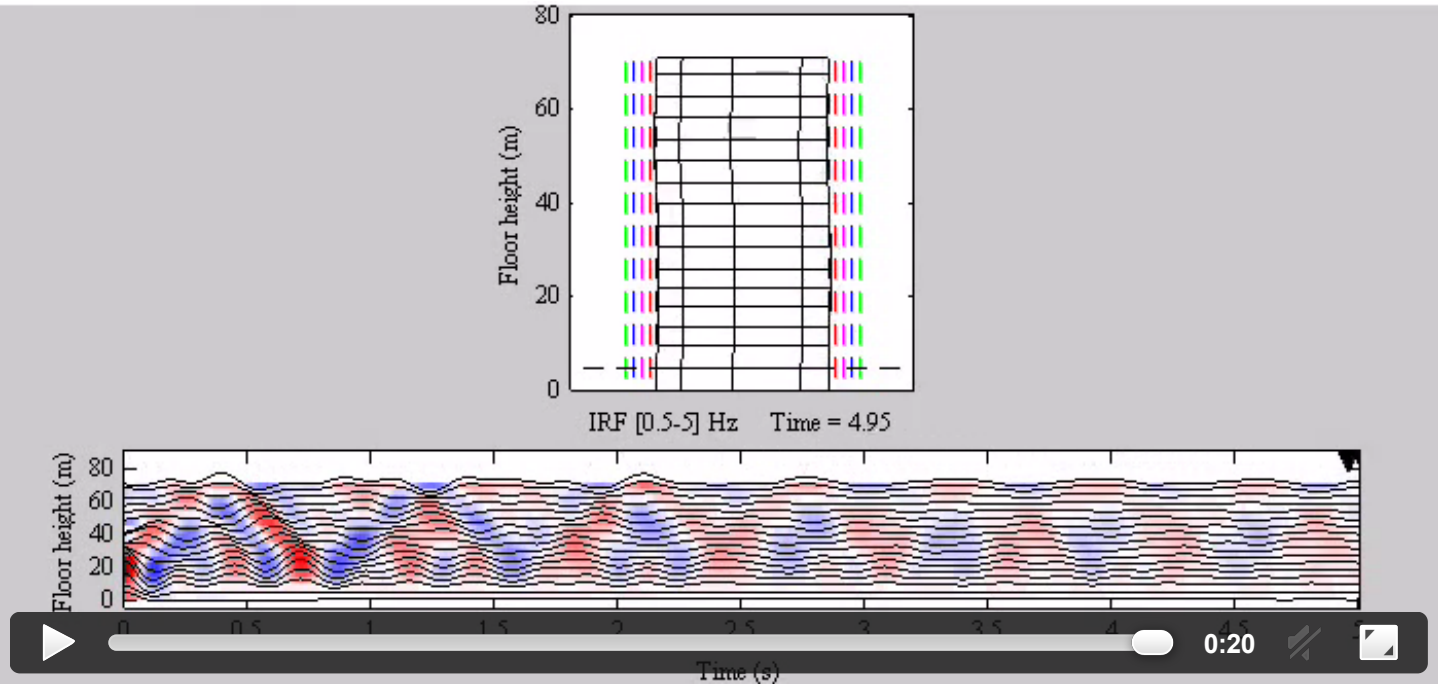
Movies of IRF and Earthquake Shaking

The time-varying displacement on each floor due to a unit displacement in the basement (Earth displacement) is provided by the IRFs. By compiling time-lapsed images of building displacements on each floor we generate movies of relative floor motion. It is assumed that the IRF at each floor represents the displacement on the entire floor. For the earthquake comparison, the movie shows the observed shaking and the predicted shaking. By convolving the recorded earthquake shaking at the basement floor with each floor's IRF (Fig. S1, see **below**) predicted displacements are generated.

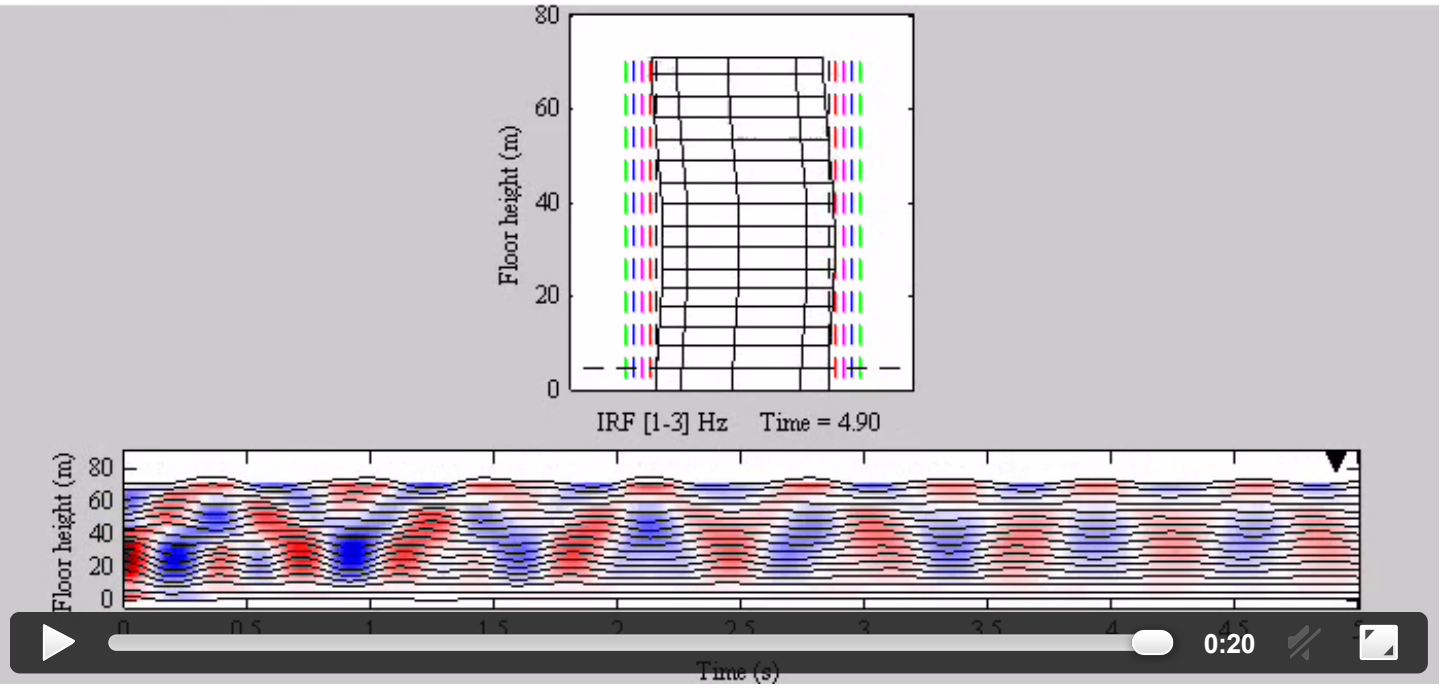
Movies



Movie S1. Exaggerated Factor Building Response to a Unit Ground Displacement

Download: **movS1.mp4** [H.264-Encoded MP4 File; 188 KB] | **movS1.ogv** [Theora-Encoded OGG File; 344 KB]

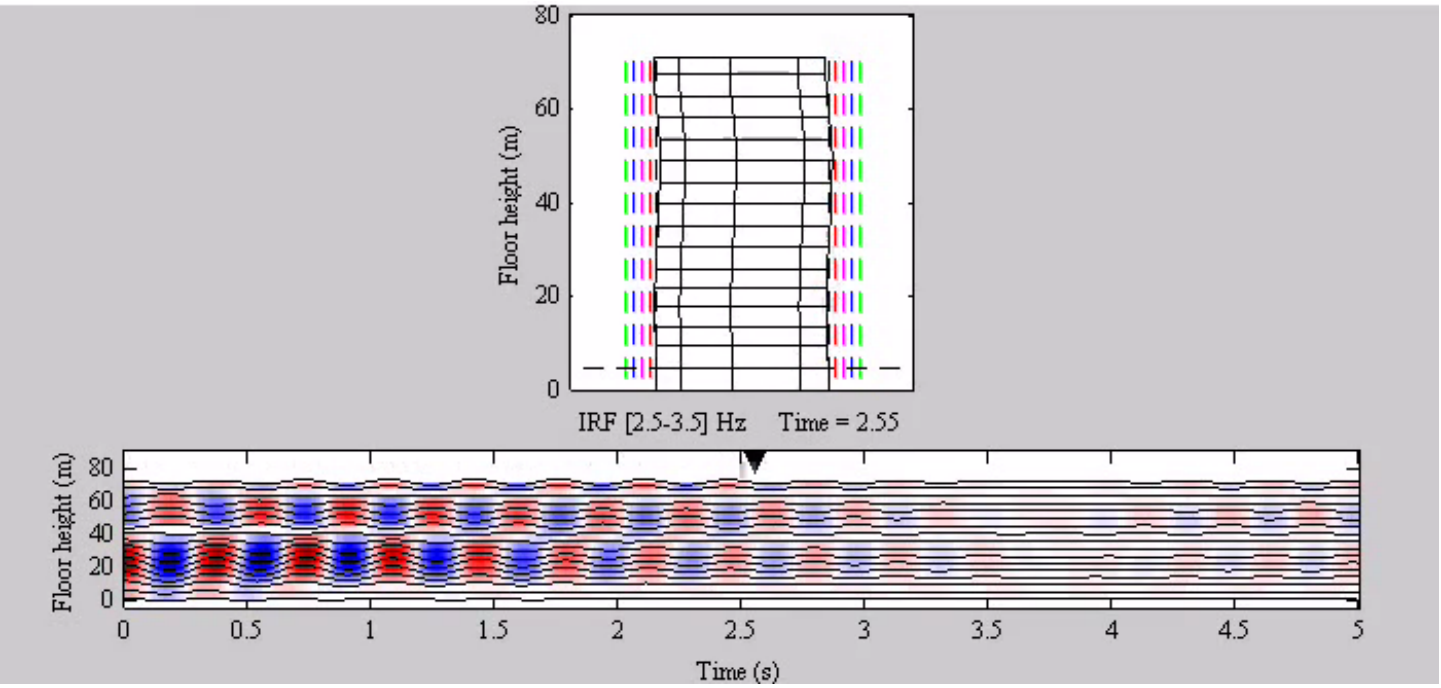
Top panel shows the south-wall face of the Factor Building displacement due to unit ground displacement in the frequency range [0.5 – 5.0] Hz. Horizontal dash line shows the ground floor and vertical dashed lines are for reference. Bottom panel shows the IRFs and triangle shows time of the response.



Movie S2. Exaggerated Factor Building Response to a Unit Ground Displacement

Download: movS2.mp4 [H.264-Encoded MP4 File; 205 KB] | movS2.ogv [Theora-Encoded OGG File; 561 KB]

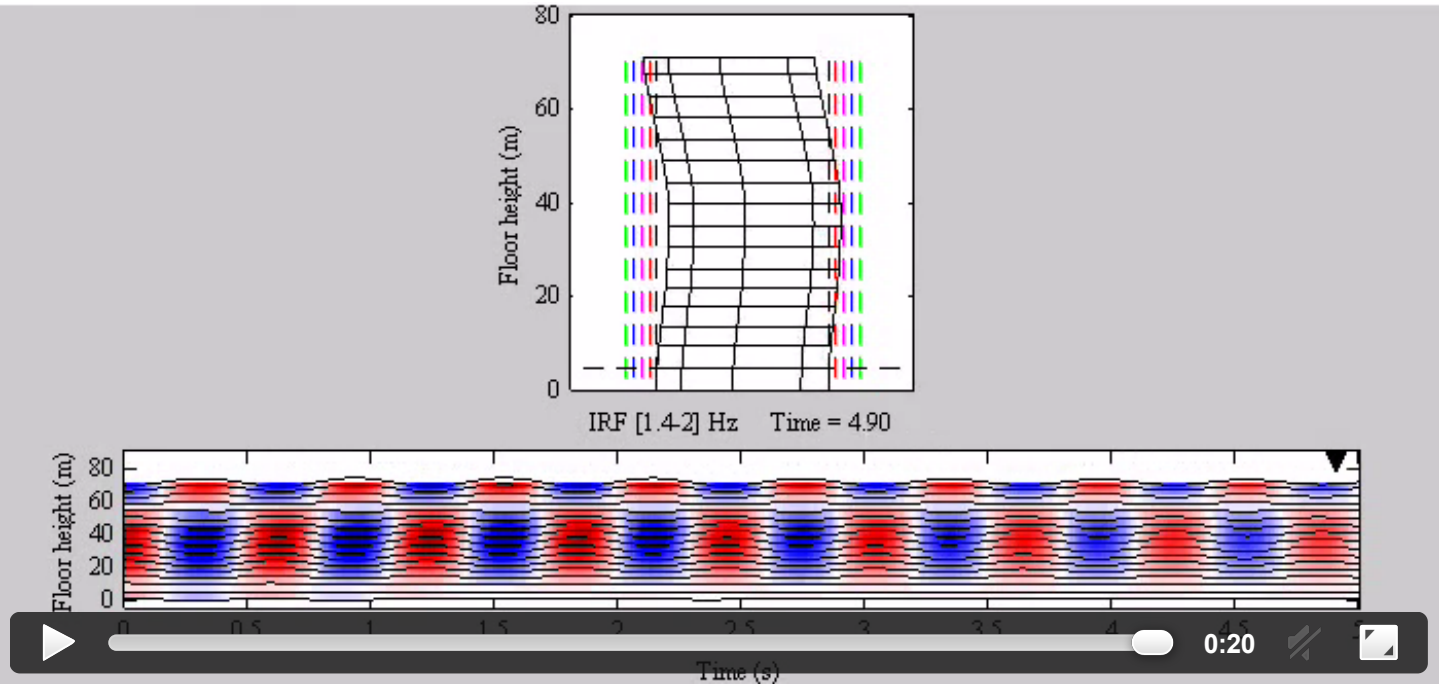
Similar to Movie S1 for an input ground displacement in the frequency range [1.0 – 3.0] Hz. The second resonance frequency is enhanced.



Movie S3. The 1st Resonance Frequency in the Factor Building

Download: movS3.mp4 [H.264-Encoded MP4 File; 209 KB] | movS3.ogv [Theora-Encoded OGG File; 553 KB]

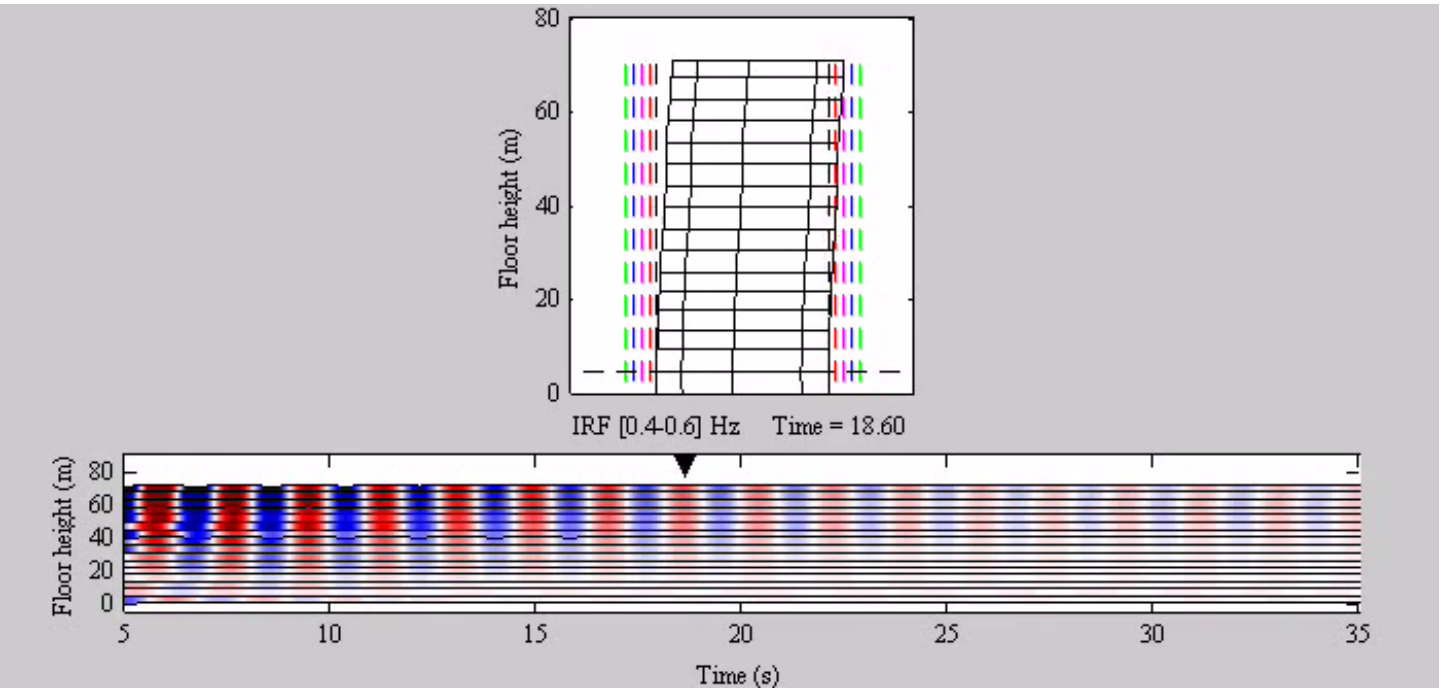
Similar to Movie S1 for the 1st resonance frequency. IRFs are filtered between 0.3 and 0.7 Hz.



Movie S4. The 2nd Resonance Frequency in the Factor Building

Download: movS4.mp4 [H.264-Encoded MP4 File; 246 KB] | movS4.ogv [Theora-Encoded OGG File; 635 KB]

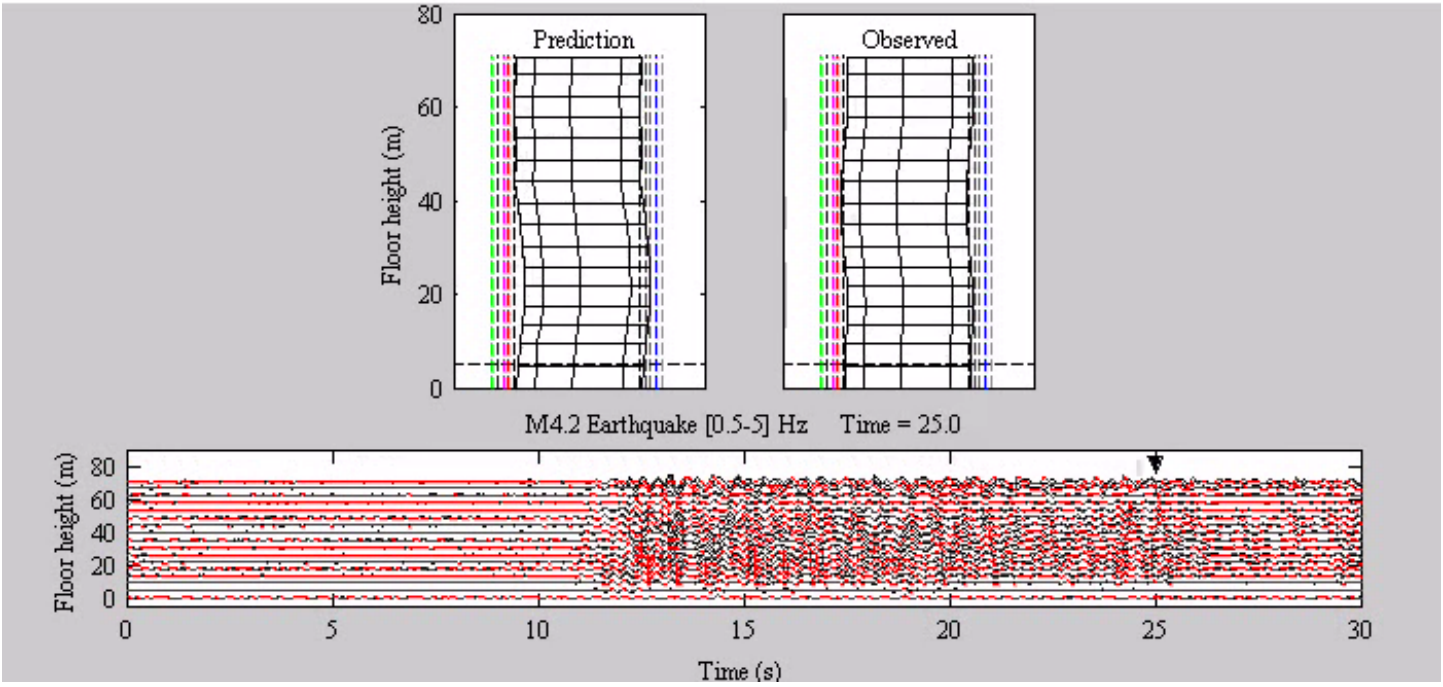
Similar to Movie S1 for the 2nd resonance frequency. IRFs are filtered between 1.4 and 2.0 Hz. The building has little motion near the tenth floor.



Movie S5. The 3rd Resonance Frequency in the Factor Building

Download: movS5.mp4 [H.264-Encoded MP4 File; 135 KB] | movS5.ogv [Theora-Encoded OGG File; 356 KB]

Similar to Movie S1 for the 3rd resonance frequency. IRFs are filtered between 2.5 and 3.5 Hz. The building has little motion near the seventh and twelfth floors.

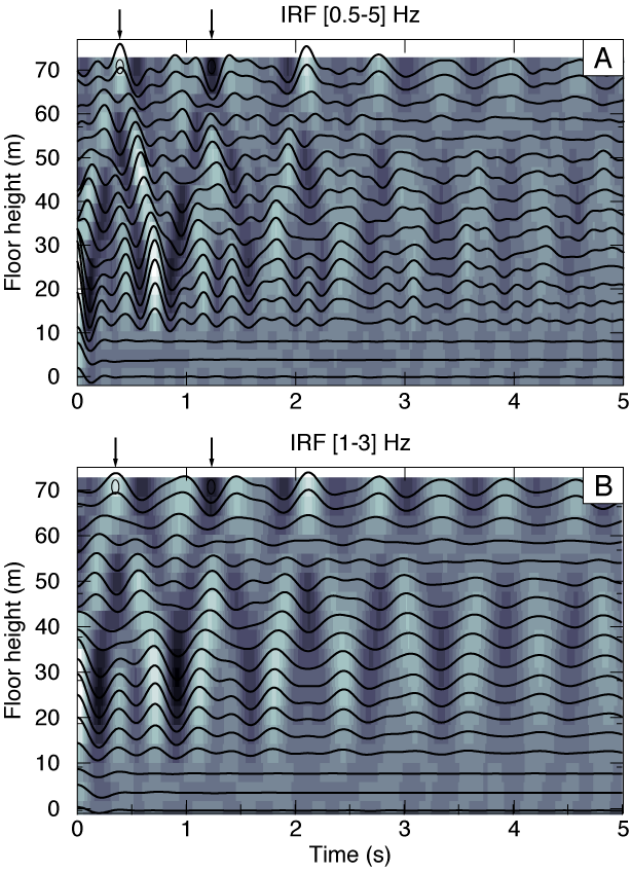


Movie S6. Exaggerated observed and predicted earthquake motions for the Factor Building

Download: movS6.mp4 [H.264-Encoded MP4 File; 135 KB] | movS6.ogv [Theora-Encoded OGG File; 356 KB]

We generate movies of predicted and observed building displacements on each floor for comparison. Both predicted and observed motions are filtered between 0.5 – 5.0 Hz. Top panel are Similar to Movie S6, for the observed and predicted motions. Bottom panel shows the observed (red) and predicted (black) time series, from which building motions are drawn.

Figure



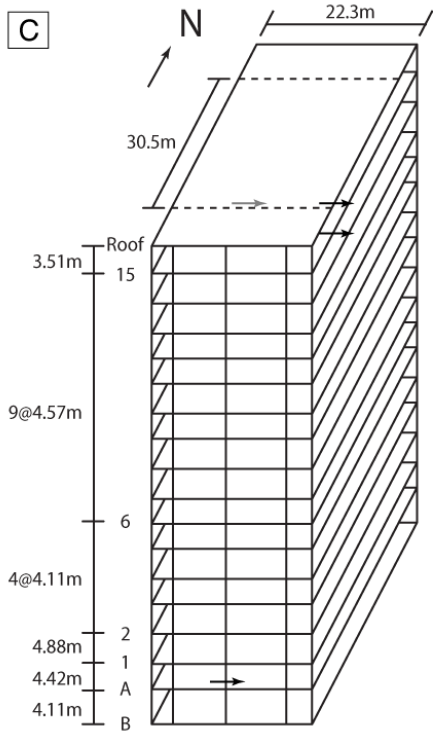


Figure S1.

Impulse response functions calculated from 14 days of ambient noise plotted as positive and negative amplitudes for each floor over time. Panel A) illustrates the IRFs for a broad frequency range (0.5-5Hz) and panel B) illustrates the resonance of the second harmonic (1.6 Hz). These IRFs are similar to those seen in Kohler *et al.* [Figure 7b, 2007]. Arrows above each panel are used to estimate two-way travel times (upgoing waves) for the station at the roof with corresponding velocities of 177 and 169 m/s respectively. Panel C) shows the locations of the EW-component sensors. The gray arrow depicts the locations of the sensors for floors 1-14. The black arrows show the locations of the sensors on floors A, 15, and the roof.

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